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DOE-HDBK-1110-97
October 1997

Reaffirmation
July 2002

Change Notice 1
November 2004

DOE HANDBOOK

ALARA TRAINING FOR TECHNICAL SUPPORT PERSONNEL



U.S. Department of Energy
Washington, D.C. 20585

FSC 6910

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Page/Section	Change
Throughout document	Revise Radcon Manual to RadCon Standard.
iii, Forward, last para.	<p>Revise bottom para to read (updated software used and web address):</p> <p>This Handbook is available in Word 2002 and has been formatted for printing on an HP IV (or higher) LaserJet printer. The overheads are available in PowerPoint 2002. Copies of this Handbook may be obtained from either the DOE Radiation Safety Training Home Page Internet site (http://www.eh.doe.gov/radiation/RST/rstmater.htm) or the DOE Technical Standards Program Internet site (http://www.eh.doe.gov/techstds/). Documents downloaded from the DOE Radiation Safety Training Home Page Internet site may be manipulated using the software noted above (current revision or higher).</p>
Part 1 page 12	<p>Revise:</p> <p>DOE-HDBK-1131-98, "General Employee Radiological Training," and DOE-HDBK-1130-98, "Radiological Worker Training". In addition, DOE/EH has issued guidelines for evaluating the effectiveness of radiological training through the DOE Operations Offices and DOE Field Offices. For additional guidance, refer to DOE-STD-1070-94, "Guide for Evaluation of Nuclear Facility Training Programs."</p> <p>To read:</p> <p>DOE-HDBK-1131-98, Reaffirmation 2004 "General Employee Radiological Training," and DOE-HDBK-1130-98, Reaffirmation 2004, "Radiological Worker Training". In addition, DOE/EH has issued guidelines for evaluating the effectiveness of radiological training through the DOE Operations Offices and DOE Field Offices. For additional guidance, refer to DOE-STD-1070-94, Reaffirmation 1999, "Guide for Evaluation of Nuclear Facility Training Programs."</p>

Part 1, page 17	<p>Revise:</p> <p>U.S. Department of Energy, <i>Guide to Good Practices for Training and Qualification of Instructors</i>, DOE-NE-STD-1001-91, Washington, D.C., 1991.</p> <p>U.S. Department of Energy, <i>Radiological Control Standard</i>, DOE-STD-1098-99, Washington, D.C., July 1999.</p> <p>U.S. Department of Energy, DOE Order 5400.5, <i>Radiation Protection of the Public and the Environment</i>, Washington, D.C.</p> <p>To read:</p> <p>U.S. Department of Energy, <i>Guide to Good Practices for Training and Qualification of Instructors</i>, DOE-HDBK-1001-96, Washington, D.C., 1996.</p> <p>U.S. Department of Energy, <i>Radiological Control Standard</i>, DOE-STD-1098-99, Ch. 1, Washington, D.C., June 2004.</p> <p>U.S. Department of Energy, DOE Order 5400.5, Ch. 2, <i>Radiation Protection of the Public and the Environment</i>, Washington, D.C.</p>
Part 2, page 14 Part 3, pages 1, 4 and 5 Part 5, pages 10 and 181	<p>Revise: DOE Order 5400.5</p> <p>To read: DOE Order 5400.5, Ch. 2,</p>

Foreword

This Handbook describes a recommended implementation process for training as outlined in the *DOE Radiological Control Standard (RadCon Standard)*. The Handbook is to assist those individuals within Department of Energy (DOE), Managing and Operating (M&O) contractors, and Managing and Integrating (M&I) contractors, identified as having responsibility for implementing the training recommended by the *RadCon Standard*. This training may also be given to technical support personnel to assist in meeting their job-specific training requirements of 10 CFR 835.

This Handbook contains recommended training materials consistent with other DOE radiological training material. The training material consists of the following documents:

Program Management Guide - This document contains detailed information on how to use the Handbook material.

Instructor's Guide - This document contains a lesson plan for instructor use, including notation of key points for inclusion of facility-specific information.

Student's Guide - This document contains student handout material and also should be augmented by facility-specific information.

Appendices - This document contains appendices that augment the Instructor's and Student's Guides.

Overhead Transparencies - This document contains recommended overhead transparencies that may be used to augment classroom presentation.

This Handbook is available in Word 2002 and has been formatted for printing on an HP IV (or higher) LaserJet printer. The overheads are available in PowerPoint 2002. Copies of this Handbook may be obtained from either the DOE Radiation Safety Training Home Page Internet site (<http://www.eh.doe.gov/radiation/RST/rstmater.htm>) or the DOE Technical Standards Program Internet site (<http://www.eh.doe.gov/techstds/>). Documents downloaded from the DOE Radiation Safety Training Home Page Internet site may be manipulated using the software noted above (current revision or higher).

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(Part 1 of 5)

ALARA Training for Technical Support Personnel

Program Management Guide



**Coordinated and Conducted
for
Office of Environment, Safety & Health
U.S. Department of Energy**

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Table of Contents

	Page
Introduction.....	1
Purpose and Scope.....	1
Management Guide Content.....	1
Training Goal.....	1
Organizational Relationship and Reporting Structure.....	1
Instructional Materials Development.....	3
Target Audience	3
Prerequisites.....	3
Training Materials.....	4
Exemptions.....	4
Training Program Standards and Policies.....	5
Qualification of Instructors.....	5
Technical Qualifications.....	5
Instructional Capability and Qualifications.....	7
Selection of Instructors.....	9
Test Administration.....	10
Program Records and Administration.....	12
Training Program Development/Change Requests.....	12
Audit (Internal and External).....	12
Evaluating Training Program Effectiveness.....	12
Course-Specific Information.....	13
Purpose.....	13
Course Goal.....	13
Target Audience.....	13
Course Description.....	13
Prerequisites.....	13
Length.....	14
Test Bank.....	14
Retraining.....	14
Instructor Qualifications.....	14
Materials Checklist.....	15
Equipment Checklist.....	16
Bibliography.....	17

Introduction**Purpose and Scope**

This program management guide provides guidance for proper implementation of training as outlined in the *DOE Radiological Control Standard (RadCon Standard)*. The guide is meant to assist those individuals within the Department of Energy (DOE), Managing and Operating (M&O) contractors, and Managing and Integrating (M&I) contractors identified as having responsibility for implementing the training recommended by the *RadCon Standard*. Facilities should determine the applicability of this material to support existing programs meant to comply with the training required by 10 CFR 835. Facilities are encouraged to revise these materials as appropriate.

Management Guide Content

The management manual is divided into the following sections:

- Introduction
- Instructional Materials Development
- Training Program Standards and Policies
- Course-Specific Information

Training Goal

The goal of the training program is to provide a baseline knowledge for those individuals completing the training. Implementation of the training provides personnel with the information necessary to perform their assigned duties at a predetermined level of expertise.

Organizational Relationships and Reporting Structure

The DOE Office of Worker Protection Policy and Programs (EH-52) is responsible for approving and maintaining the training materials.

**Organizational Relationships and
Reporting Structure (continued)**

The establishment of a comprehensive and effective Contractor site radiological safety training program is the responsibility of line management and their subordinates. The training function can be performed by a separate training organization, but the responsibility for quality and effectiveness rests with the line management.

Instructional Materials Development Next

Instructional Materials Development

Target Audience

Course instructional materials were developed for specific employees who are responsible for knowing or using the knowledge or skills for each course. With this in mind, the participant should never ask the question, “Why do I need to learn this?” However, this question is often asked when the participant cannot apply the content of the program. It is the responsibility of management to select and send workers to training who need the content of the program. When workers can benefit from the course, they can be motivated to learn the content and apply it on their jobs. Care should be taken to read the course descriptions along with the information about who should attend. Participants and DOE facilities alike will not benefit from workers attending training programs unsuitable for their needs.

Prerequisites

A background and foundation of knowledge facilitates the trainee in learning new knowledge or skills. It is much easier to learn new material if it can be connected or associated to what was previously learned or experienced. Curriculum developers who have been involved in preparing instructional materials for the additional standardized training know this and have established what is referred to as “prerequisites” for each course.

Certain competencies or experiences of participants were also identified as necessary prior to participants attending a course. Without these competencies or experiences, the participants would be at a great disadvantage and could be easily discouraged and possibly fail the course. It is not fair to the other participants, the unprepared participant, and the instructor to have this misunderstanding.

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Instructional Materials Development (continued)

Training Materials

Training materials for this training program consist of a program management guide, an instructor's guide, a student's guide, appendices, and overhead transparencies. This material is designed to be supplemented with facility-specific information.

Supplemental material and training aids may be developed to address facility-specific radiological concerns and to suit individual training styles. References are cited in each lesson plan and may be used as a resource in preparing facility-specific information and training aids.

Each site is responsible for establishing a method to differentiate the facility-specific information from the standardized lesson plan material. When additional or facility-specific information is added to the text of the lesson plan material, a method should be used to differentiate site information from standardized material.

Exemptions

Qualified personnel can be exempted from training if they have satisfactorily completed training programs (i.e., facility, college or university, military, or vendor programs) comparable in instructional objectives, content, and performance criteria. Documentation of the applicable and exempted portions of training should be maintained.

Training Program Standards and Policies Next

Training Program Standards and Policies

Qualification of Instructors

The technical instructor plays a key role in the safe and efficient operation of DOE facilities. Workers must be well qualified and have a thorough understanding of the facility's operation, such as processing, handling, and storage of materials, and maintenance of equipment. Workers must know how to correctly perform their duties and why they are doing them. They must know how their actions influence other worker's responsibilities. Because workers' actions are so critical to their own safety and the safety of others, their trainers must be of the highest caliber. The technical instructor must understand thoroughly all aspects of the subjects being taught and the relationship of the subject content to the total facility. Additionally, the instructor must have the skills and knowledge to employ the instructional methods and techniques that will enhance learning and successful job performance. While the required technical and instructional qualifications are listed separately, it is the combination of these two factors that produces a qualified technical instructor.

The qualifications are based on the best industry practices that employ performance-based instruction and quality assurances. These qualifications are not intended to be restrictive, but to help ensure that workers receive the highest quality training possible. This is only possible when technical instructors possess the technical competence and instructional skills to perform assigned instructional duties in a manner that promotes safe and reliable DOE facility operations.

Technical Qualifications

Instructors must possess technical competence (theoretical and practical knowledge along with work experience) in the subject areas in which they conduct training. The foundation for determining the instructor's technical qualifications is based on two factors:

- the trainees being instructed and
- the subject being presented.

The following is an example of a target audience, subject to be taught, and instructor technical qualifications.

Continued on Next Page

TARGET AUDIENCE	SUBJECT BEING TAUGHT	INSTRUCTOR TECHNICAL QUALIFICATIONS
Personnel with job assignments that include or support the design of nuclear facilities, the planning of radiological work, or the production of procedures that govern radiological work.	ALARA Principles	Demonstrated knowledge and skills in radiation protection, above the level to be achieved by the trainees, as evidenced by previous training/education and through job performance.

Methods for verifying the appropriate level of technical competence may include the review of prior training and education, observation, and evaluation of recent related job performance, and oral or written examination. Other factors that may be appropriate for consideration include DOE, NRC, or other government license or certification, vendor or facility certification, and most importantly, job experience. To maintain technical competence, a technical instructor should continue to perform satisfactorily on the job and participate in continuing technical training.

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Training Program Standards and Policies (continued)

Instructional Capability and Qualifications

Qualifications of instructional capability should be based on demonstrated performance of the instructional tasks for the specific course requirements and the instructor's position. Successful completion of instructor training and education programs as well as an evaluation of on-the-job performance is necessary for verification of instructional capability. Instructional capability qualification should be granted as the successful completion of an approved professional development program for training instructors. The program should contain theory and practice of instructional skills and techniques; adult learning; and planning, conducting, and evaluating classroom, simulator, laboratory, and on-the-job training activities.

Illustrated talks, demonstrations, discussions, role playing, case studies, coaching, and individual projects and presentations should be used as the principal instructional methods for presenting the instructional training program. Each instructional method should incorporate the applicable performance-based principles and practices. Every effort should be made to apply the content to actual on-the-job experience or to simulate the content in the classroom/laboratory. The appropriate methodology required to present the instructional content will indicate a required level of instructional qualification and skill.

Current instructors' training, education, and job performance should be reviewed to determine their training needs for particular courses. Based on this review, management may provide exemptions based on demonstrated proficiency in performing technical instructor's tasks.

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Training Program Standards and Policies (continued)

Instructional Capability and Qualifications (continued)

Through training or experience, technical instructors should be able to*:

- Review instructional materials and modify to fully meet the needs of the training group.
- Arrange the training facility (classroom/laboratory or other instructional setting) to meet the requirements for the training sessions.
- Effectively communicate (verbally and non-verbally) lessons to enhance learning.
- Invoke student interaction through questions and student activity.
- Respond to students' questions.
- Provide positive feedback to students.
- Use appropriate instructional materials and visual aids to meet the lesson objectives.
- Administer performance and written tests.
- Ensure evaluation materials and class rosters are maintained and forwarded to the appropriate administrative personnel.
- Evaluate training program effectiveness.
- Modify training materials based on evaluation of training program.

*Stein, F., *Instructor Competencies: The Standards*. International Board of Standards for Training, Performance and Instruction, 1992.

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Training Program Standards and Policies (continued)

Selection of Instructors

Selection of instructors should be based on the technical and instructional qualifications specified in the Course-Specific Information section of this guide. In addition to technical and instructional qualifications, oral and written communication skills and interpersonal skills should be included in the process of selecting and approving instructors.

Since selection of instructors is an important task, those who share in the responsibility for ensuring program effectiveness should:

- Interview possible instructors to ensure they understand the importance of the roles and responsibilities of technical instructors and are willing to accept and fulfill their responsibilities in a professional manner.
- Maintain records of previous training, education, and work experience.

Procedures for program evaluation will include documentation of providing qualified instructors for generic and facility-specific training programs.

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Training Program Standards and Policies (continued)

Test Administration

A test bank of questions for each course that has an exam should be developed and its content validated. As the test banks are used, statistical validation of the test banks should be performed to fully refine the questions and make the tests as effective as possible. The questions contained in the test banks are linked directly to the objectives for each course. In this way, trainee weaknesses can be readily identified, and remedial procedures can be put into place. The test outcomes can also be used to document competence and the acquisition of knowledge.

The test banks should also be used by the instructors to identify possible weaknesses in the instruction. If numerous trainees fail to correctly answer a valid set of questions for an objective, the instruction for that objective needs to be reviewed for deficiencies.

Written examinations may be used to demonstrate satisfactory completion of theoretical classroom instruction. The following are some recommended minimal requirements for the test banks and tests:

- Randomly generate tests from the test bank.
- Represent all course objectives.
- Validate the content of all test bank items by a subject matter expert.
- Secure test banks and do not release them either before or after the test is administered.

Continued on Next Page

Training Program Standards and Policies (continued)

Test Administration (continued)

- Provide feedback to trainees on their test performance.
- For the first administrations of tests, require a minimum of 80 percent correct for a passing score. As statistical analyses of test results are performed, a more accurate percentage for a passing score may be identified.

Test administration is critical in accurately assessing the trainee's acquisition of knowledge being tested. The following rules should be followed:

- Announce tests at the beginning of the training sessions.
- Instructors should continuously monitor trainees during examinations.
- Collect all tests and answers at the conclusion of each examination.
- No notes can be made by trainees concerning the test items.
- Efforts should be made to eliminate all noise during the test.
- Allow no talking, aside from questions.
- Provide answers to trainees' questions during a test, but not answers to test items.
- Where possible, produce multiple versions of each test from the test bank for each test administration.

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Training Program Standards and Policies (continued)

Test Administration (continued)

- After test completion, trainees may turn in their materials and leave the room while other trainees complete their tests.
- Trainee scores on the tests are confidential.

Program Records and Administration

Training records and documentation shall meet the requirements of CFR 835.704

Training Program Development/Change Requests

All requests for program changes and revisions should use the form “Document Improvement Proposal” provided at the end of this document.

Audit (Internal and External)

Internal verification of training effectiveness should be accomplished through senior instructor or supervisor observation of practical applications and discussions of course material. All results should be documented and maintained by the organization responsible for Radiological Control training.

The training materials and processes should be evaluated on a periodic basis by DOE-HQ. The evaluation should include a comparison of program elements with applicable industry standards and requirements.

Evaluating Training Program Effectiveness

Verification of the effectiveness of Radiological Control training should be accomplished per DOE-HDBK-1131-98, Reaffirmation 2004, “General Employee Radiological Training,” and DOE-HDBK-1130-98, Reaffirmation 2004, “Radiological Worker Training”. In addition, DOE/EH has issued guidelines for evaluating the effectiveness of radiological training through the DOE Operations Offices and DOE Field Offices. For additional guidance, refer to DOE-STD-1070-94, Reaffirmation 1999, “Guide for Evaluation of Nuclear Facility Training Programs.”

Course-Specific Information Next

Course-Specific Information

Purpose

This section of the program management guide is to assist those individuals assigned responsibility for implementing the *ALARA Training for Technical Support Personnel*.

Course Goal

Upon completion of this training, the student will have a basic understanding of the philosophy and principles of ALARA and their application to the facility and to facility and equipment design.

Target Audience

Personnel with job assignments that include or support the design of nuclear facilities, the planning of radiological work, or the production of procedures that govern radiological work. This training, or portions of it, may be appropriate for managers and supervisors of people in these categories.

Course Description

This course reinforces the skills and knowledge needed to apply ALARA principles (including optimization) to facility and operational designs and reviews. This course emphasizes application of ALARA principles by participation in group exercises. It also provides an overview of radiological fundamentals that may be presented by alternative methods. This course is developed in accordance with Articles 652/653 of the RadCon Standard.

Prerequisites

This training material is designed to augment the DOE Radiological Worker training. As a refresher, this course includes Radiological Worker training material, but is not intended to replace Radiological Worker training. The first three modules may be issued as a self-study. It is a general overview of Radiological Worker topics. The presentation of the remainder of the course may be adjusted accordingly.

Continued on Next Page

Course Specific Information (continued)

Prerequisites (continued)

The facility training program should determine the appropriate prerequisites. However, it is recommended that students complete Radiological Worker training prior to taking this course.

Length

The suggested course length is two days; however, the scope and amount of training should be evaluated by each site based on probable average dose savings.

Test Bank

On a site-by-site basis.

Retraining

Retraining is not required for this course unless it is used to meet 10 CFR 835 training requirements. In that case, retraining every two years is required. Since some of the content is based on facility-specific information, retraining should also be provided as facility-specific information changes.

Instructor Qualifications

Instructors of this course have a major role in making it successful and meeting the specified objectives. Instructors must have related experience and be technically competent. In this course it is imperative that the instructor have the background and experience of working in radiological facilities. Instructors must be able to relate their own work experience to the facility workers. Instructors must be able to answer specific questions and use a variety of instructional material to meet the objectives.

Education: Minimum of B.S. degree in Health Physics or related discipline is preferred.

Certification: Certification by American Board of Health Physics (ABHP) or National Registry of Radiation Protection Technologists (NRRPT) is preferred.

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Course Specific Information (continued)

**Instructor Qualifications
(continued)**

Experience: At least five years of applied radiological protection experience in an operating radiological facility including experience in radiological protection and the applicable ALARA principles is preferred. The areas of experience should include:

- Radiological Systems
- ALARA Principles
- ALARA Optimization Processes

The instructor must also be knowledgeable in Federal regulations and guidance, and best nuclear industry practices pertaining to radiological protection.

Materials Checklist

The following checklist should be used to ensure all training materials are available. The Program Management Guide, Instructors Guide, and Student Guide are provided in WordPerfect 8.0 format. The Overheads and Student Handouts are provided in PowerPoint 9.0 format.

- Program Management Guide
- Instructor's Guide
- Student's Guide
- Appendices
- Overheads/Student Handouts

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Course Specific Information (continued)

Equipment Checklist

The following checklist should be used before training is provided to ensure equipment is available and working.

- Overhead projector
- Screen
- Flip chart, chalkboard, or white board
- Markers or chalk

Bibliography Next

Bibliography:

DOE standards, handbooks, and technical standards lists (TSLs).
The following DOE standards, handbooks, and TSLs form a part of this document to the extent specified herein.

U.S. Department of Energy, *Guide to Good Practices for Training and Qualification of Instructors*, DOE-HDBK-1001-96, Washington, D.C., 1996.

U.S. Department of Energy, *Proceedings of the Department of Energy ALARA Workshop, Held at Brookhaven National Laboratory, Upton, NY 11973, April 1992*, Conf-920468, Brookhaven National Laboratory, Upton, NY.

U.S. Department of Energy, Training Resource and Data Exchange, TRADE, *ALARA for Design and Operations Engineers*, Oak Ridge Institute for Science and Education, Oak Ridge, TN, April 1993.

U.S. Department of Energy, *Radiological Control Standard*, DOE-STD-1098-99, Ch. 1, Washington, D.C., July 1999.

U.S. Department of Energy, *Occupational ALARA Program Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection*, DOE G-441.1-2, March 1999.

U.S. Department of Energy, *Health Physics Manual of Good Practices for Reducing Radiation Exposure to As Low As Reasonably Achievable (ALARA)*. PNL-6577, Pacific Northwest Laboratory, Richland, WA.

U.S. Department of Energy, DOE Order 5400.5, Ch. 2, *Radiation Protection of the Public and the Environment*, Washington, D.C.

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Other government documents, drawings, and publications. The following government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise indicated, the issues of these documents are those cited in the contracting document.

U.S. Environmental Protection Agency, Federal Guidance Report No. 11.

Non-Government documents

Baum, John W., Health Physics Society, *Proceedings of the Twenty-Fourth Midyear Topical meeting of the Health Physics Society, Raleigh, NC*, "ALARA at Nuclear Power Plants," January 1991.

International Commission on Radiation Protection, ICRP Publication 37, *Cost- Benefit Analysis in the Optimization of Radiation Protection*. Pergamon Press, New York, NY, 1982.

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Jorgensen, David B., et al., editors, Health Physics Society, *Proceedings of the Twenty Fouth Midyear Topical meeting of the Health Physics Society, Raleigh, NC*, "Implementation of Current NCRP and ICRP Guidance and Revised 10 CFR Part 20," January 1991.